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# Development of an Aerobic Exercise Program to Improve Physical Fitness among Vocational College Students in Henan Province

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## Abstract

**Background and Aims:** Aerobics is a rhythmic exercise that combines dance, gymnastics, and calisthenics to improve cardiorespiratory endurance, muscular endurance, flexibility, and physical coordination. This study aimed to develop an aerobics exercise program for vocational college students in Henan Province to improve physical fitness and address the decline in health-related fitness components caused by sedentary behavior and insufficient physical activity.

**Methodology:** This study employed a mixed-methods design. Quantitative data were collected from 60 vocational college students with low baseline physical fitness who participated in the experimental phase and were randomly assigned to either the experimental group, which completed an 8-week aerobics exercise program, or the control group, which attended regular physical education classes. Qualitative data were obtained through expert interviews, focus group discussions, and connoisseurship evaluation to develop and refine the aerobics training program. The data were analyzed using descriptive statistics, independent-samples t-tests, repeated-measures ANOVA, and Bonferroni post hoc comparisons.

**Results:** The experimental group demonstrated significant improvement in the 800-meter run from 3:55 ± 0:15 to 3:25 ± 0:11 ($p < .01$), in the Sit and Reach Test from 11.24 ± 2.15 cm to 16.85 ± 2.02 cm ($p < .05$), and in the One-Minute Sit-Up Test from 24.15 ± 3.24 repetitions to 31.84 ± 2.91 repetitions ($p<.01$). The control group also improved slightly, but the magnitude of change was smaller than that of the experimental group. Repeated-measures ANOVA confirmed significant improvement across the intervention period.

**Conclusion:** The 8-week aerobics exercise program effectively improved cardiorespiratory endurance, flexibility, and muscular endurance among vocational college students in Henan Province. The findings suggested that structured and progressive aerobics training could be integrated into college physical education programs to support long-term physical fitness development and healthier exercise behaviors among students.

**Keywords:** Aerobics Exercise Program; Physical Fitness; Vocational College Students



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## Introduction

Aerobics is a structured and rhythmic form of physical exercise that combines dance, gymnastics, and calisthenics with music to improve cardiorespiratory endurance, muscular endurance, flexibility, and body coordination. As a physical activity integrating physiological training and aesthetic movement expression, aerobics has been widely adopted in Chinese colleges and universities since its introduction into higher education in the 1980s. The coordinated movement patterns involved in aerobics not only enhance cardiovascular and muscular function but also strengthen rhythm perception and artistic expression (Ivanov & Marandykina, 2024). Government initiatives such as China's National Fitness Program Outline have further promoted the integration of aerobics instruction with public health strategies in higher education institutions (Han, 2022).

In recent years, the physical fitness level of Chinese college students has shown a continuous decline, particularly in health-related fitness components such as cardiorespiratory endurance, flexibility, and muscular endurance. Vocational college students in Henan Province deserve special attention because many students experience limited exercise participation, heavy academic and vocational training demands, insufficient access to sports facilities, and low awareness of long-term fitness behaviors. Prolonged sedentary lifestyles and inadequate moderate-to-vigorous physical activity have become major contributing factors to declining health conditions among this population. Previous studies also indicated that Chinese female college students generally performed poorly in endurance and flexibility assessments (Chen et al., 2022). Aerobics was selected in this study because rhythmic continuous movement combined with stretching and repeated muscular activity can effectively improve cardiorespiratory endurance, flexibility, and muscular endurance while maintaining student motivation and participation. Based on the current physical fitness problems of vocational college students, this study developed an 8-week aerobics intervention program to improve health-related physical fitness and encourage sustainable exercise behaviors.

## Research Objectives

1. To examine the current exercise behaviors and physical fitness problems of vocational college students in Henan Province.
2. To develop an aerobics exercise program to improve the physical fitness of vocational college students in Henan Province.
3. To examine the effects of the aerobics exercise program on selected physical fitness components among vocational college students in Henan Province.



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## Literature Review

### Aerobics history

Aerobics, as a structured form of physical activity, originated in 1968 when Dr. Kenneth H. Cooper introduced the concept through his seminal work emphasizing continuous moderate-intensity exercise, including jogging, cycling, and rhythmic movement, to enhance cardiorespiratory endurance and prevent cardiovascular disease (Choudhary, 2018). Initially designed to improve military personnel's fitness, aerobics rapidly gained public popularity during the 1970s and 1980s, driven by mass media and home video formats, with figures like Jane Fonda promoting at-home workouts, which facilitated the evolution of aerobics into subtypes such as step aerobics, aqua aerobics, and competitive aerobics, accommodating diverse ages, fitness levels, and social contexts. In China, aerobics was introduced in the early 1980s as Western health and fitness concepts influenced domestic institutions, and by 1985, university-level teaching materials were published, followed by integration into physical education curricula and institutionalized national competitions in the 1990s, culminating in China's first participation in the FIG World Aerobics Championships by 1995, marking the beginning of professionalization and international alignment (He, 2020). Entering the 21st century, aerobics instruction in China adopted blended formats combining in-person teaching with multimedia and online platforms such as TED and MOOCs, enhancing student engagement and instructional efficiency in alignment with Education Modernization 2035 strategies (Ting et al., 2025). National initiatives, including the National Fitness Plan and Healthy China 2030, supported the integration of aerobics into formal education to improve public health and student physical literacy, while studies emphasized that humanistic curriculum design in physical education promoted not only physical health but also emotional support, interpersonal relationships, and social cohesion (Li & Kang, 2025). In vocational education, where students often exhibit lower fitness levels, aerobics provides accessible, engaging, and community-oriented programs, and technological innovations such as AI-powered personalized teaching models using biosensors and deep learning algorithms demonstrated high accuracy in predicting student fitness metrics, enhancing adaptability and individualized instruction (Wang & Zainuddin, 2024).

### Exercise program

An aerobics exercise program consisted of a structured sequence of rhythmic, music-guided movements aimed at improving cardiorespiratory endurance, flexibility, and muscular strength, typically implemented in colleges and vocational institutions as accessible and low-cost physical education courses to enhance student fitness and mental well-being (Olawale, 2023). The program integrated aerobic movements such as marching, grapevine steps, knee lifts, and jumping jacks, flexibility training through static and dynamic stretching, and muscle power exercises



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including squats, lunges, planks, and abdominal routines, often choreographed to 32-beat sequences accompanied by music to promote engagement and adherence (Perdana et al., 2025). Teaching methods evolved to include blended learning models combining in-person practice with online resources, with evidence showing that vocational students in these programs achieved greater fitness improvements and engagement, and sessions typically spanned 6–12 weeks, incorporating warm-up, main training, and cool-down phases, enhancing cardiovascular capacity, joint mobility, muscular power, teamwork, and exercise adherence, while offering a practical and inclusive intervention for students with limited exercise experience (Smith, 2023).

**Physical fitness for aerobics**

Health-related physical fitness comprised cardiorespiratory endurance, flexibility, and muscular strength or power, reflecting an individual's capacity to perform daily tasks energetically without excessive fatigue (Adam,2020). Aerobics programs directly targeted these components through structured rhythmic movements integrating endurance, stretching, and strength exercises, with moderate-intensity actions such as marching or knee lifts shown to enhance $VO_2$max and improve performance in standard fitness tests including the 800-meter run for females and 1000-meter run for males (Gao & Fauzi, 2025). Flexibility improved through dynamic and static stretching incorporated into warm-ups, cool-downs, and choreographed sequences, measurable via sit-and-reach tests widely used in Chinese student assessments, while muscular strength and power developed through core exercises, squats, lunges, and explosive jumps, enhancing sit-up and standing long jump performance (Dong & Zhang, 2023). These gains were particularly crucial for vocational college students in China, whose baseline fitness was lower, academic and training pressures were heavier, and access to exercise facilities was limited (Liu, 2023). Aerobics, as a low-cost, minimal-equipment, group-oriented activity, integrated seamlessly into public physical education courses and provided an engaging platform to improve health-related fitness. Despite supporting evidence, research gaps persisted, especially regarding longitudinal studies of vocational student populations, and addressing these gaps would further establish aerobics as an effective, scalable intervention for enhancing fitness and health outcomes in this underserved group (Manerikar & Manerikar, 2014).

**Physical fitness tests**

Physical fitness testing served as a cornerstone in aerobics research, providing empirical and measurable indicators of physiological and functional adaptations resulting from structured aerobic interventions targeting cardiorespiratory endurance, flexibility, and muscular endurance (Ye & Liu, 2023). Field-based assessments, including the 800 m and 1000 m run tests, were widely employed to estimate $VO_2$max and aerobic capacity, demonstrating significant correlations with body mass index and maximal aerobic speed across diverse student populations (Zhang et al.,



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2022). Flexibility was commonly evaluated through sit and reach tests, which assessed hamstring and lower back mobility and showed criterion validity in large-scale national surveys of Chinese college students (Yang et al., 2023). Muscular endurance was commonly assessed using the one-minute sit-up test, which effectively measured the endurance capacity of the abdominal muscles and showed responsiveness to aerobic-based interventions in large student populations (Moraes et al., 2024). These tests were particularly relevant for vocational college students who typically exhibited lower baseline fitness, time constraints, and limited facility access, as their simplicity and scalability allowed whole-class assessment while providing immediate and motivating feedback.

### Summary

The study designed and implemented a structured aerobics exercise program for vocational college students in Henan Province, integrating rhythmic aerobic movements, dynamic and static stretching, and core strength exercises choreographed with music to enhance engagement, adherence, and enjoyment. Physical fitness assessments, including running, sit-and-reach, standing long jump, and sit-up tests, were used to evaluate improvements in cardiorespiratory endurance, flexibility, and muscular strength, demonstrating significant gains across these domains. The program effectively addressed low baseline fitness, limited facility access, and heavy academic pressures, providing a low-cost, inclusive, and scalable intervention that enhanced overall physical fitness, promoted teamwork, and encouraged consistent participation in structured exercise among vocational students.

## Conceptual Framework

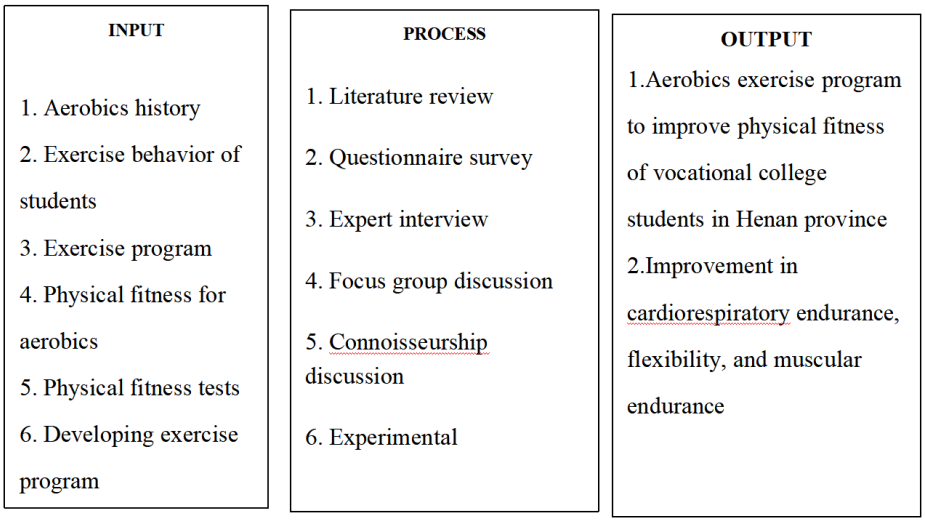



**Figure 1** Conceptual Framework



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## Methodology

### Research Tools

#### 1. Student Questionnaire

The student questionnaire was a quantitative research instrument developed from related literature and designed using a five-point Likert scale. It measured students' exercise behaviors, attitudes toward aerobics, and motivational factors. The questionnaire was validated by three experts using the IOC method, with IOC values ranging from 0.60–1.00 to ensure content validity and consistency with the research objectives.

#### 2. Expert Interview Questionnaire

The expert interview questionnaire was a qualitative research instrument developed from a literature review and preliminary questionnaire findings. Open-ended questions were used to explore physical fitness problems, training needs, and key elements of effective aerobics instruction. The collected qualitative data were analyzed and applied to improve the structure and content of the aerobics exercise program.

#### 3. Focus Group Outline

The focus group outline was designed as a qualitative research tool based on literature review, student questionnaire responses, and expert interview feedback. Open-ended discussion topics focused on students' fitness problems, exercise motivation, and recommendations for program development. The qualitative findings were used to refine the training activities and teaching strategies of the aerobics exercise program.

#### 4. Connoisseurship Outline

The connoisseurship outline was developed as a qualitative instrument using open-ended evaluation guidelines. Experts including physical education teachers, aerobics coaches, sports scientists, and curriculum specialists reviewed the proposed 8-week aerobics program. Their comments and recommendations were analyzed and used to confirm the suitability, feasibility, and effectiveness of the intervention program before implementation.

#### 5. Aerobics Exercise Program

The aerobics exercise program was an 8-week structured intervention designed for vocational college students. The program included rhythmic aerobic activities, stretching exercises, and core endurance training to improve cardiorespiratory endurance, flexibility, and muscular endurance. The training plan specified exercise frequency, session duration, training intensity, progression stages, and major activities to support program replication.

#### 6. Physical Fitness Tests

The physical fitness tests were quantitative research instruments used to assess cardiorespiratory endurance, flexibility, and muscular endurance. The test items included the 800-



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meter run, sit-and-reach test, and one-minute sit-up test. The 800-meter run was measured in minutes and seconds, the sit-and-reach test was measured in centimeters, and the one-minute sit-up test was measured by the number of repetitions completed. Each test clearly described the testing procedures, number of trials, and scoring methods, providing objective data for evaluating improvements in physical fitness after the intervention.

## Population and Sample

### *Population*

The population of this study consisted of students enrolled in the compulsory aerobics public course at Henan Communication Vocational and Technical College during the 2025 academic year. Approximately 400 students from 8 classes participated in the course, with each class containing about 50 students. All participants were non-sports major students who generally demonstrated limited exercise experience and relatively low levels of health-related physical fitness compared with students from comprehensive universities.

### *Sample for Questionnaire Survey*

The sample for the questionnaire survey was selected from the total population of approximately 400 students enrolled in the aerobics public course. Cluster sampling was used by randomly selecting several classes to participate in the survey. A total of 387 valid questionnaires were returned and used for data analysis. The questionnaire survey aimed to collect information regarding students' exercise behaviors, physical fitness problems, attitudes toward aerobics exercise, and training needs.

### *Sample for Experimental Study*

Among the students who completed the questionnaire survey and voluntarily agreed to participate in the experiment, 60 students with relatively low baseline physical fitness were selected as experimental participants. Baseline physical fitness was determined using three physical fitness tests, including the 800-meter run, sit-and-reach test, and one-minute sit-up test. Since the tests used different units of measurement, the raw scores were converted into standardized scores before calculating a composite physical fitness score. The students with the lowest composite scores were identified as having lower baseline physical fitness and were selected for the intervention.

The 60 participants were assigned to two groups using a systematic sampling method. The experimental group (n = 30) participated in the 8-week aerobics exercise program, while the control group (n = 30) attended regular physical education classes. Both groups completed pre-test, mid-test, and post-test assessments during the study period.



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*Criteria for Inclusion. The inclusion criteria were as follows:*

1. Participants were in good general health and free from chronic diseases or physical injuries.

2. Participants voluntarily agreed to participate and signed an informed consent form.

3. Participants had not participated in structured aerobic or resistance training programs within the previous three months.

4. Participants were able to attend all scheduled training sessions and physical fitness assessments throughout the 8-week intervention period.

*Criteria for Exclusion. The exclusion criteria were as follows:*

1. Students who developed injuries, illnesses, or health problems during the intervention period that prevented safe participation.

2. Students whose attendance rate fell below 85% or who missed more than two consecutive training sessions.

3. Students who participated in additional intensive sports training or competitions outside the study.

4. Students who voluntarily withdrew or failed to complete the post-test assessments.

**Experts Involved in the Study**

Three experts were invited to evaluate the content validity of the student questionnaire and expert interview questionnaire using the Index of Item Objective Congruence (IOC), with IOC values ranging from 0.60–1.00. The experts were selected through purposive sampling and included university lecturers in physical education, sports science specialists, and experienced aerobics instructors with more than five years of professional experience.

For the qualitative phase, seven experts participated in the interviews, and nine participants joined the focus group discussion. In addition, a panel of experts, including vocational college physical education teachers, senior aerobics coaches, sports science researchers, and curriculum specialists, participated in the connoisseurship evaluation to review and confirm the suitability and effectiveness of the 8-week aerobics exercise program before implementation.

**Data Collection**

The study collected data through a comprehensive literature review, expert interviews, and focus group discussions to inform the design of the aerobics program, identify challenges in vocational students' physical fitness, and finalize program components. A preliminary trial with five students assessed exercise intensity, instruction clarity, time allocation, and engagement, leading to minor adjustments. Sixty vocational college students participated in an eight-week intervention, with the experimental group following the developed aerobics program and the control group continuing regular physical education. Physical fitness was measured under



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standardized conditions, including an 800 m run for cardiorespiratory endurance, sit-and-reach for flexibility, and one-minute sit-ups for muscular strength, with pre-, mid-, and post-tests conducted to track changes and compare outcomes between groups.

**Data Analysis**

***Descriptive Statistics***

Mean ($\overline{X}$) and standard deviation (SD) will be used to analyze the data collected from vocational college students at Henan Communication Vocational and Technical College. These statistics will summarize students' exercise behaviors, physical fitness levels, and questionnaire responses.

***Likert Scale Analysis***

Data from the student questionnaire, measured on a 5-point Likert scale, will be analyzed to evaluate students' perceptions of aerobics training and their reported difficulties in physical activity participation. The mean scores for each indicator will be calculated based on student responses. The interpretation of the 5-point scale will follow Bruininks & Bruininks (2005):

| Average Score Range | Meaning |
|---|---|
| 5.00 – 4.51 | Highest |
| 4.50 – 3.51 | High |
| 3.50 – 2.51 | Moderate |
| 2.50 – 1.51 | Poor |
| 1.50 – 1.00 | Very Poor |

***Content Validity Assessment***

The Item Objective Congruence (IOC) index will be calculated to evaluate the content validity of the questionnaire and interview outlines. IOC values ranging from 0.60 to 1.00 will be considered acceptable for ensuring consistency between the research instruments and research objectives.

***Qualitative Analysis***

Content analysis will be conducted to analyze data obtained from expert interviews, focus group discussions, and connoisseurship evaluations. The qualitative findings will be categorized into themes related to students' physical fitness problems, training needs, motivational factors, and recommendations for improving the aerobics exercise program.

***Independent Sample t-test***

Independent-samples t-tests will be used to compare the physical fitness results between the experimental group and the control group at the pre-test, mid-test, and post-test stages. The



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comparisons will include cardiorespiratory endurance (800-meter run), flexibility (sit-and-reach test), and muscular endurance (one-minute sit-up test).

*Repeated-Measures ANOVA*

The results of the pre-test, mid-test (after 4 weeks), and post-test (after 8 weeks) for both the experimental group and the control group will be analyzed using repeated-measures ANOVA to examine changes over time within each group. Post Hoc (Bonferroni) tests will be conducted to identify significant differences among the three measurement periods. This analysis will help determine whether the aerobics exercise program produced greater improvement than the regular physical education program. Before conducting repeated-measures ANOVA, statistical assumptions, including normality and sphericity, will be tested to ensure the appropriateness of the analysis procedure.

## Results

The research findings are organized into three main sections as follows:

**Part 1: Examining the current status and issues related to physical fitness learning and performance among students at vocational colleges in Henan.**

This study administered face-to-face questionnaires to 387 students enrolled in a compulsory aerobics course at a vocational college in Henan during the 2025 academic year to examine their physical fitness learning and performance. The results are shown in Table 1.

**Table 1** Results of the student questionnaire survey, investigating the current situation and issues of physical fitness among students at vocational colleges in Henan Province (n=387)

| No. | Content | Mean | SD | Evaluation criteria |
|---|---|---|---|---|
| 1 | I engage in physical exercise regularly. | 3.78 | 0.98 | High |
| 2 | I consider my overall physical fitness to be good. | 3.51 | 0.92 | High |
| 3 | My physical fitness level is sufficient for daily activities. | 3.84 | 0.94 | High |
| 4 | I am confident in my athletic abilities. | 3.64 | 0.93 | High |
| 5 | Physical fitness is important for my academic success. | 3.81 | 0.83 | High |
| 6 | I participate in physical activities outside of class. | 3.95 | 0.86 | High |
| 7 | The aerobics class intensity is suitable for my fitness level. | 3.76 | 0.81 | High |
| 8 | I have noticed improvements in my fitness after aerobics classes. | 3.64 | 0.86 | High |
| 9 | I face challenges in improving my fitness. | 3.78 | 0.89 | High |



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| No. | Content | Mean | SD | Evaluation criteria |
|---|---|---|---|---|
| 10 | Aerobics classes help me improve my endurance. | 3.99 | 0.96 | High |
| 11 | My flexibility has improved after attending aerobics classes. | 3.87 | 0.81 | High |
| 12 | My muscle strength has improved after attending aerobics classes. | 3.89 | 0.85 | High |
| 13 | The aerobics classes are appropriate for my fitness level. | 3.91 | 0.86 | High |
| 14 | I am satisfied with the aerobics teaching methods. | 3.72 | 0.80 | High |
| 15 | I feel motivated to participate in physical activities. | 3.94 | 0.91 | High |
| 16 | I have injuries or limitations that affect my fitness. | 3.61 | 0.85 | High |
| 17 | I practice physical activities outside of class frequently. | 3.82 | 0.92 | High |
| 18 | I prefer individual fitness guidance over group activities. | 3.75 | 0.83 | High |
| 19 | My diet plays a significant role in my physical fitness. | 3.61 | 0.89 | High |
| 20 | A structured fitness plan would help me improve my physical health. | 3.96 | 0.84 | High |
| | **Total** | **3.79** | **0.88** | **High** |

The results indicated that students generally maintained regular exercise habits and perceived their physical fitness as sufficient for daily activities, demonstrating moderate to high confidence in their athletic abilities. Respondents recognized the importance of fitness for academic success and reported improvements in endurance, flexibility, and muscle strength through aerobics classes, while challenges in further enhancing fitness persisted. Preferences for individualized guidance and structured fitness plans were also notable, reflecting a desire for personalized support to optimize physical development.

**Part 2: Developing an aerobics teaching plan to improve the physical fitness of students at vocational colleges in Henan.**

Interviews with seven specialists indicated that vocational college students in Henan Province generally demonstrated low levels of cardiorespiratory endurance, flexibility, and core strength. Therefore, the experts recommended an 8-week progressive aerobics exercise program tailored to students' individual fitness levels to prevent injuries and maximize training effectiveness. The experts emphasized the importance of baseline testing and continuous



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assessment using the 800-meter run, sit-and-reach test, and one-minute sit-up test. They also highlighted that motivational strategies, individualized feedback, and recovery periods were essential for maintaining student participation and exercise adherence.

Focus Group Results: Discussions with nine participants further emphasized the need for a structured and progressive training program that integrated core training, flexibility exercises, and functional strength activities. In addition, rhythmic, varied, and game-based exercise activities were recommended to improve students' physical performance and mental adaptability. The experts agreed that individualized exercise plans, continuous assessment, and real-time feedback were necessary to ensure long-term and comprehensive physical fitness development among vocational college students.

**Table 2** Framework of Aerobics Exercise Program Design to Improve Students' Physical Fitness at Vocational Colleges in Henan Province

| Week | Training Focus | Aerobic Exercise Development | Physical Fitness Components | Practice Drills | Evaluation Focus |
|---|---|---|---|---|---|
| 1 | Basic adaptation | Introduction to aerobic exercise, breathing rhythm, and basic movement patterns | Initial cardiorespiratory adaptation, flexibility activation, and core endurance | Warm-up routines, low-impact aerobics steps, basic jogging, stretching, and sit-up practice | Pre-test (800-meter run, sit-and-reach test, 1-minute sit-ups) |
| 2 | Aerobic foundation | Continuous aerobic movement sequences and rhythm control | Cardiorespiratory endurance, joint mobility, and abdominal endurance | Low-impact aerobic combinations, brisk walking and jogging drills, dynamic stretching, and core training | Exercise adaptation |
| 3 | Coordination development | Arm-leg coordination, movement combinations, and tempo control | Movement coordination, flexibility improvement, and muscular endurance | Step aerobics, aerobic dance combinations, repeated sit-up sets, and flexibility routines | Movement coordination and exercise consistency |
| 4 | Endurance progression | Longer continuous aerobic routines with moderate intensity | Cardiorespiratory endurance, trunk stability, and lower-back | Continuous aerobic circuits, interval jogging, stretching drills, and | Mid-test for experimental group (800-meter run, sit-and-reach |



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| Week | Training Focus | Aerobic Exercise Development | Physical Fitness Components | Practice Drills | Evaluation Focus |
|---|---|---|---|---|---|
| | | | and hamstring flexibility | abdominal endurance practice | test, 1-minute sit-ups) |
| 5 | Intensity enhancement | Progressive aerobic combinations and sustained exercise performance | Cardiorespiratory endurance, muscular strength, and flexibility maintenance | Moderate-to-vigorous aerobics routines, tempo-based drills, core strengthening, and static stretching | Mid-program improvement |
| 6 | Strength-endurance integration | Aerobic exercise integrated with muscular endurance training | Muscular endurance, recovery efficiency, and flexibility support | Circuit aerobics, bodyweight conditioning, repeated abdominal exercises, and mobility drills | Muscular endurance monitoring |
| 7 | Performance application | Sustained aerobic performance and pacing control | Cardiorespiratory endurance, abdominal strength, and flexibility quality | Mixed aerobic circuits, timed running practice, sit-up challenge drills, and full-sequence routines | Performance stability |
| 8 | Performance consolidation | Refinement of aerobics movement quality and overall exercise performance | Comprehensive improvement in endurance, flexibility, and muscular strength | Performance simulation, full aerobics routine practice, stretching, and review drills | Post-test (experimental group and control group: 800-meter run, sit-and-reach test, 1-minute sit-ups) |

**Part 3: Experimenting with the aerobics teaching plan to enhance the physical fitness of students at vocational colleges in Henan.**

This section conducted an 8-week aerobics intervention with experimental and control groups to evaluate improvements in cardiorespiratory endurance, flexibility, and muscular strength among vocational college students in Henan.



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**Table 3** The basic information of subject on experimental group and control group.

| Variables | Experimental group | Control group |
|---|---|---|
| | $\overline{X}$ ±SD | $\overline{X}$ ±SD |
| Age (year) | 21.33±1.16 | 20.91±1.23 |
| Height (cm) | 177.70±3.11 | 177.30±3.41 |
| Weight (kg) | 70.95±4.86 | 68.25±5.39 |
| BMI | 22.45±1.19 | 21.72±1.73 |

Table 3 presents the basic information of the subjects in the experimental and control groups. Both groups consist of 30 participants, with ages of 21.33±1.16 years and 20.91±1.23 years, heights of 177.70±3.11 cm and 177.30±3.41 cm, weights of 70.95±4.86 kg and 68.25±5.39 kg, and BMIs of 22.45±1.19 and 21.72±1.73, respectively. The data indicate that the two groups have minor differences in age, height, and weight, with the experimental group showing slightly higher weight and BMI than the control group. However, all values fall within the normal range, suggesting that the subjects in both groups are comparable in terms of basic physiological indicators.

**Table 4** Comparison of Pre-Test Results of Aerobics Exercise Program Between Experimental and Control Groups (Independent Samples t-Test).

| Variables | Experimental group | Control group | 95% Confidence Interval of the Difference | | t | p |
|---|---|---|---|---|---|---|
| | $\overline{X}$ ±SD | $\overline{X}$ ±SD | Lower | Upper | | |
| 800-meter run | 3:55 ±0:15 | 3:52 ± 0:13 | -0.85 | 0.73 | -0.23 | 0.72 |
| Sit and Reach Test | 17.35 ± 1.15 | 17.38 ± 1.21 | -0.46 | 0.33 | 0.21 | 0.84 |
| One-Minute Sit-Up Test | 32.41 ± 2.11 | 32.43 ± 2.15 | -0.32 | 0.67 | -0.82 | 0.42 |

*p<0.05

Table 4: The comparison of pre-test results for the 800-meter run, Sit and Reach test, and One-Minute Sit-Up test between the experimental and control groups reveals no significant differences in baseline physical fitness.800-meter Run: The experimental group had an average time of 3:55 ±0:15 seconds, while the control group performed slightly better with an average of 3:52 ± 0:13 seconds. The independent samples t-test shows a p-value of 0.72, indicating no significant difference between the two groups. This suggests that both groups were comparable in their cardiovascular endurance before the intervention.Sit and Reach Test: The experimental



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group had an average score of 17.35 ± 1.15 cm, and the control group scored 17.38 ± 1.21 cm. The t-test produced a p-value of 0.84, showing that there was no statistically significant difference in flexibility between the two groups at baseline. Both groups had similar flexibility levels before the aerobics program. One-Minute Sit-Up Test: The experimental group achieved an average of 32.41 ± 2.11 sit-ups, while the control group scored 32.43 ± 2.15 sit-ups.

**Table 5** Comparison of Post-Test Results of Aerobics Exercise Program Between Experimental and Control Groups (Independent Samples t-Test).

| Variables | Experimental group | Control group | 95% Confidence Interval of the Difference | | t | p |
|---|---|---|---|---|---|---|
| | $\overline{X}$ ±SD | $\overline{X}$ ±SD | Lower | Upper | | |
| 800-meter run | 3:25 ±0:11 | 3:53 ± 0:12 | 0.62 | 1.14 | -4.56 | 0.01* |
| Sit and Reach Test | 17.38 ± 1.17 | 20.57 ± 1.32 | 0.57 | 2.23 | 2.62 | 0.01* |
| One-Minute Sit-Up Test | 32.80 ± 1.95 | 41.50 ± 2.32 | 0.83 | 2.46 | 2.45 | 0.01* |

*p<0.05

Table 5: The post-test results show significant improvements in the physical fitness of both the experimental and control groups, with the experimental group demonstrating more substantial improvements.800-meter Run: The experimental group improved to 3:25 ±0:11 seconds, while the control group improved to 3:53 ± 0:12 seconds. The t-test produced a p-value of 0.01, indicating a statistically significant difference between the two groups. The experimental group showed a greater improvement, suggesting that the aerobics exercise program had a positive effect on their cardiovascular endurance, compared to the control group.Sit and Reach Test: The experimental group's post-test result was 17.38 ± 1.17 cm, while the control group's result increased to 20.57 ± 1.32 cm. The p-value of 0.01 shows a significant difference, but the control group showed a greater improvement in flexibility than the experimental group. This could suggest that other factors, such as independent stretching or daily activity, may have influenced the control group's flexibility gains. One-Minute Sit-Up Test: The experimental group achieved 32.80 ± 1.95 sit-ups, while the control group improved to 41.50 ± 2.32 sit-ups. The p-value of 0.01 indicates that the difference is statistically significant. Although both groups showed improvements, the control group outperformed the experimental group, which could indicate that other factors, such as baseline abdominal strength, might have played a role.



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**Table 6** Comparison of cardiorespiratory endurance (800-meter run) within the experimental group at pre-test, mid-test, and post-test using repeated measures ANOVA.

| Variable | Source of variance | Sum of squares | df | MS | F | p |
|---|---|---|---|---|---|---|
| 800-meter run | Between group | 48.32 | 2 | 24.16 | 18.72 | 0.01* |
| | Within group | 60.65 | 48 | 1.26 | | |
| | Total | 108.97 | 50 | | | |

*p<0.05

Table 6: A repeated measures ANOVA performed on the experimental group's 800-meter run times across the three testing stages demonstrates a statistically significant effect of time on performance, with a sum of squares for time reaching 48.32, a mean square of 24.16, and an F-value of 18.72. The associated p-value, being less than 0.001, affirms that performance changes were not random but systematically progressed during the intervention. This consistent improvement implies that the training regimen led to meaningful physiological adaptations over time.

**Table 7** Comparison of cardiorespiratory endurance (800-meter run) within the experimental group at pre-test, mid-test, and post-test, and comparison between the two groups using the Bonferroni test.

| Variables | Test | Pre-test | Mid-test | Post-test |
|---|---|---|---|---|
| 800-meter run | Pre-test | - | 0.90* | 2.00* |
| | Mid-test | - | - | 1.10* |
| | Post-test | - | - | - |

*p<0.05

Table 7: The comparison of the 800-meter run test results at three time points demonstrates clear and consistent improvement within the experimental group. The gap between pre-test and mid-test reached 0.90 ($p < .05$), while the difference increased to 2.00 ($p < .05$) between the pre-test and post-test, indicating substantial performance enhancement as the training advanced. The improvement from mid-test to post-test, recorded at 1.10 ($p < .05$), further illustrates the value of sustained and systematic training interventions. These results reflect the



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comprehensive design of the training program, which incorporated elements such as speed endurance, aerobic base building, and pacing strategies.

**Table 8** Comparison of flexibility (sit-and-reach test) within the experimental group at pre-test, mid-test, and post-test using repeated measures ANOVA.

| Variable | Source of variance | Sum of squares | df | MS | F | p |
|---|---|---|---|---|---|---|
| Sit and Reach Test | Between group | 196.30 | 2 | 198.15 | 18.72 | 0.01* |
| | Within group | 195.20 | 43 | 6.87 | | |
| | Total | 391.50 | 45 | | | |

*p<0.05

Table 8: The comparison of flexibility within the experimental group at pre-test, mid-test, and post-test using repeated measures ANOVA reveals a statistically significant improvement in flexibility over time. The between-group sum of squares is 196.30, with a mean square of 198.15, and the F-value is 18.72, with a p-value of 0.01. These results indicate that the experimental group showed significant changes in flexibility at different time points during the intervention. The significant F-value and p-value demonstrate that the flexibility improvement is not random, but rather a result of the structured intervention. This supports the effectiveness of the aerobics program in enhancing flexibility.

**Table 9** Comparison of flexibility (sit-and-reach test) within the experimental group at pre-test, mid-test, and post-test, and comparison between the two groups using the Bonferroni test.

| Variables | Test | Pre-test | Mid-test | Post-test |
|---|---|---|---|---|
| Sit and Reach Test | Pre-test | - | 5.20* | 10.30* |
| | Mid-test | - | - | 5.10* |
| | Post-test | - | - | - |

*p<0.05

Table 9 presents a comparison of flexibility within the experimental group at pre-test, mid-test, and post-test, as well as a comparison between the two groups using the Bonferroni test. The results show significant improvement within the experimental group at each time point. From pre-test to mid-test, the improvement was 5.20 ($p < 0.05$), and from mid-test to post-test, it was 5.10 ($p < 0.05$). These results demonstrate that the experimental group showed consistent



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progress in flexibility throughout the intervention. The Bonferroni post hoc test further confirms these significant changes. Additionally, the comparison between the two groups illustrates that the experimental group made more substantial gains in flexibility compared to the control group.

**Table 10** Comparison of muscular strength (one-minute sit-up test) within the experimental group at pre-test, mid-test, and post-test using repeated measures ANOVA.

| Variable | Source of variance | Sum of squares | df | MS | F | p |
|---|---|---|---|---|---|---|
| One-Minute Sit-Up Test | Between group | 102.80 | 2 | 51.40 | 12.345 | 0.01* |
| | Within group | 116.60 | 28 | 4.164 | | |
| | Total | 219.40 | 30 | | | |

*p<0.05

Table 10: The comparison of muscular strength (one-minute sit-up test) within the experimental group at pre-test, mid-test, and post-test using repeated measures ANOVA shows a statistically significant effect of time on performance. The between-group sum of squares is 102.80, with a mean square of 51.40, and the F-value is 12.345, with a p-value of 0.01, indicating that there was a significant difference in muscular strength over time within the experimental group ($p < 0.05$). This result suggests that the experimental group's muscular strength improved significantly throughout the intervention period, supporting the effectiveness of the aerobics program in enhancing muscular strength.

**Table 11** Comparison of muscular strength (one-minute sit-up test) within the experimental group at pre-test, mid-test, and post-test, and comparison between the two groups using the Bonferroni test.

| Variables | Test | Pre-test | Mid-test | Post-test |
|---|---|---|---|---|
| One-Minute Sit-Up Test | Pre-test | - | 2.70* | 5.20* |
| | Mid-test | - | - | 2.50* |
| | Post-test | - | - | - |

*p<0.05

Table 10 presents the comparison of muscular strength (one-minute sit-up test) within the experimental group at pre-test, mid-test, and post-test, as well as the comparison between the



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two groups using the Bonferroni test. The improvement from pre-test to mid-test was 2.70 ($p < 0.05$), and from mid-test to post-test, the improvement was 2.50 ($p < 0.05$). These results demonstrate a consistent and significant improvement in muscular strength within the experimental group throughout the intervention. The Bonferroni post hoc test further confirms these significant changes.

## Conclusion

The study developed and implemented an 8-week aerobics exercise program for vocational college students in Henan Province and examined its effects on cardiorespiratory endurance, flexibility, and muscular endurance through a mixed-methods design. Questionnaire findings from 387 students revealed that the overall perception of physical fitness and aerobics participation was at a high level, with a total mean score of 3.79 ± 0.88, while students also reported strong recognition of the importance of physical fitness for academic success (3.81 ± 0.83) and noticeable improvements in endurance, flexibility, and muscular strength after participating in aerobics classes. Statistical analysis demonstrated that the experimental group achieved significant improvement in the 800-meter run, improving from 3:55 ± 0:15 at pre-test to 3:25 ± 0:11 at post-test ($p = 0.01$), indicating enhanced cardiorespiratory endurance after the intervention. Repeated-measures ANOVA further confirmed significant progress in the experimental group across the intervention period, with F-values of 18.72 for the 800-meter run, 18.72 for flexibility, and 12.345 for the one-minute sit-up test ($p < 0.05$). Bonferroni comparisons also showed continuous improvement between pre-test, mid-test, and post-test measurements. Although the control group obtained higher post-test mean scores in the sit-and-reach test and one-minute sit-up test, the overall findings suggested that the aerobics exercise program contributed positively to selected aspects of physical fitness, particularly cardiorespiratory endurance, among vocational college students in Henan Province.

## Discussion

The discussion examined the effectiveness of the 8-week aerobics intervention program designed to improve the physical fitness of vocational college students in Henan Province (Gao & Fauzi, 2025). The pre-test findings showed no significant differences between the experimental and control groups in cardiorespiratory endurance, flexibility, and muscular endurance, indicating that both groups started from comparable physical fitness levels. After the intervention, the experimental group demonstrated significant improvement in the 800-meter run ($p = 0.01$), Sit and Reach Test ($p = 0.01$), and One-Minute Sit-Up Test ($p = 0.01$), suggesting that the structured aerobics program positively influenced multiple components of health-related physical fitness.



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The improvement in cardiorespiratory endurance was likely associated with continuous rhythmic aerobic movement, interval jogging, and sustained moderate-intensity exercise included throughout the training sessions, which enhanced cardiovascular efficiency and oxygen utilization. Flexibility development may have resulted from the repeated use of dynamic and static stretching exercises integrated into warm-up, cool-down, and movement combination activities, improving lower back and hamstring mobility (Olawale, 2023). Improvements in muscular endurance were likely influenced by repeated sit-up practice, bodyweight conditioning, and core endurance exercises progressively incorporated into the weekly training plan, which strengthened abdominal muscle endurance and trunk stability. Repeated measures ANOVA further confirmed that the aerobics intervention produced meaningful physiological adaptations over time, particularly in cardiorespiratory endurance, flexibility, and muscular endurance (Liu, 2023). Although the control group demonstrated relatively higher post-test scores in flexibility and one-minute sit-up performance, the overall findings suggested that regular and progressive aerobic exercise contributed positively to the development of selected physical fitness components among vocational college students.

## Recommendation

### Recommendation for this research

1. Develop a structured weekly training schedule that gradually increases in intensity and difficulty. Ensure that exercises are tailored to students' fitness levels to maximize participation and effectiveness throughout the program.

2. Foster active participation by incorporating interactive and enjoyable elements into the training. Provide incentives for attendance and improvement to motivate students, creating a more engaging learning environment for better fitness outcomes.

3. Conduct monthly fitness assessments to track students' progress and adjust the program accordingly. Provide personalized feedback to encourage continuous improvement, addressing individual needs to optimize results.

### Recommendation for further research

1. Compare the effects of aerobics on students from different academic years, genders, and backgrounds. Investigate how these factors influence the outcomes of physical fitness improvements, allowing for more personalized aerobics programs.

2. Study the potential relationship between improved physical fitness through aerobics and academic performance. Examine how physical training might enhance students' concentration, memory, and overall academic success.



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3. Research how dietary habits and lifestyle factors interact with the effects of aerobics. Investigate the role of nutrition and daily habits in maximizing the benefits of aerobic exercise for student fitness.

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